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(21)Application number : 10-278013	(71)Applicant : SEIKO EPSON CORP
(22)Date of filing : 30.09.1998	(72)Inventor : YAMAZAKI TAKU

(54) DRIVING METHOD FOR DISPLAY DEVICE, DISPLAY DEVICE AND ELECTRONIC INSTRUMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To make a display have interest and creativity while keeping a low power consumption property by changing at least one of the position, the area or the display content of a partial area to be a display state at certain time intervals.

SOLUTION: In the whole screen enclosed with a full line, the inner side D of a broken line indicates a display state and the outer side of the line indicates a non-display state. Then, a display is successively changed over from (a) to (b), (b) to (c), (c) to (d), (d) to (e) of the figure at certain time intervals. These changeover time intervals may be constant or may be changed properly. In this case, a display content (pattern) is changed over so that a fish is successively moved from the left side of a screen to the right side of the screen. Moreover, it may be performed to change over only the number of display rows or the display content by fixing the row of the end part of the area of the partial display area D at a prescribed row. That is, it is also acceptable to successively change the row of the row end of the lower side (the lowermost scanning line of D) while making the row end of the upper side of the area D (the uppermost scanning line of D) always a fixed row.
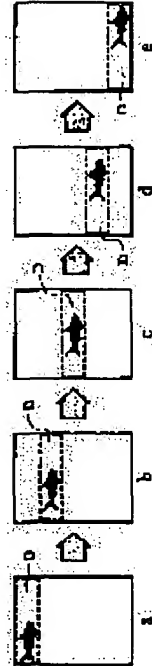
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A.   Relevance of the above-identified Document

       This document has relevance to claims 1 and 6 of the

present application.

B.   Translation of the Relevant Passages of the Document

       See the attached English Abstract.

[EMBODIMENT]

       [0023]

       (First Embodiment)

       Figure 1 illustrates an example of partial display state of a

display apparatus of the present invention. In a whole screen

surrounded by the solid line, inside D of the broken line is in a

display state, outside of the broken line is in a non-display state. At

a certain time interval, the display is switched over sequentially

from a to b, from b to c, from c to d, and from d to e. The time

interval of the switching-over may be constant or appropriately

varied. In the present embodiment, only position is changed

whereas the number of rows (the number of scanning lines) in the

partial display region D is not changed. However, in accordance

with the switching-over as to the position, the number of the rows to

be displayed (the number of the scanning lines) or content to be

displayed (display data content to be supplied to the signal lines) in the display region D may be switched over at the same time. In the present embodiment, the display content (design pattern) is switched over so that a fish sequentially moves from the left hand side of the screen to the right hand side of the same. Moreover, it may be so arranged that an edge of the partial display region D is fixed to a predetermined line, and only the number of rows to be displayed or the content to be displayed is switched over. In short, it may be so arranged that an upper edge of the broken line D (the uppermost scanning line of D) is always fixed, and a lower edge thereof (the lowermost scanning line of D) is sequentially changed. For example, as shown in Figures 2a, 2b, and 2c, the partial display state may be inserted while the switching-over of the display is being carried out. Needless to say, it may be so arranged that the lower edge is fixed, and the upper edge is sequentially changed.

[0024]

On the display panel of the present embodiment, the whole screen is display if necessary. But in waiting, only part of the display panel is displayed as shown in Figures 1 and 2, and the position, the number of row to be displayed, or the content to be displayed of the partial display region D is switched over.

[0046]

In case of a liquid crystal display apparatus having a relatively a small number of rows to be displayed, that is, 100 or less rows to be displayed, a display data storage circuit (hereinafter,

referred to as a display data RAM) for one frame is, in many cases, built in the X driver 5 for use in such liquid crystal display apparatus. In case of the present invention, it is also preferable that the display data RAM for one frame or more is built in the X driver 5, for reduction in power consumption. When the screen is in still image state, this enables the display to be continued even if the main parts of the system bus or the controller is stopped. The display apparatus usually carries out the rewriting or refreshing of the screen in a frame frequency of 60Hz or similar. For example, in case the display pattern of the partial display is switched over in a frequency of 2 seconds as shown in Figure 1, if the display data RAM is built in the X driver 5, the X driver 5 performs transmission operation of the display data to the display data RAM, only for a first one frame of about 120 frames (corresponding to 2 seconds) in which the same screen display is repeated. On the other hand, if no display data RAM is built in the X driver, it is necessary to repeat the transmission operation of the same display data for all the frames. Because the display data transmission frequency is as high as several MHz, stopping of the transmission operation of the display data is very effective for reducing the power consumption.

[0047]

Especially, if the display data RAM is built in the X driver 5 and an oscillation circuit for time reference is built in the controller 2, continuation of the display as shown in Figure 1 requires only the transmission of the display data from the system side to the display

apparatus only for the first one frame since the display is switched over to the partial display condition, without supply of the display data or the clock signal from the system side for the rest of frames. For example, if (a) the number of displayable rows (effective display scanning lines) of the display panel of Figure 1 is 200, (b) the number of rows to be displayed (the number of the scanning lines) in the partial display condition is 40, and (b) the design patterns shown in Figures 1a to 1e are written in the display data RAM in the X driver 5 in the first one frame period since the display is switched to the partial display condition, only 1 to 40 lines are displayed in the first two seconds since the display is switched over to partial display condition, as shown in Figure 1a. For the next two seconds, as shown in Figure 1b, only 41 to 80 lines are displayed. It is possible to automatically continue such display as shown in Figure 1 only by the display apparatus side itself. Because the number of times to transmit the display data from the system side to the display apparatus is significantly reduced, it is possible to realize a display apparatus having partial display function of lower power consumption. If a display data RAM for two frame is built in the X driver 5, it is possible to perform more complicate partial display.

[FIGURE 3]

1: LCD PANEL

2: CONTROLLER

3: DRIVING VOLTAGE FORMING CIRCUIT

4: Y DRIVER

5: X DRIVER

6: POWER SOURCE

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力を抑えて電池寿命を延ばすことができるので好ましい。さらには、本発明の電子機器では、機器が操作されない状態が一定時間経過した後の待機時には、表示装置は部分表示状態となって、図3に示したドライバやコントローラでの表示装置の駆動による消費電力を抑えるので、より一層電池寿命を延ばすことができる。

【0054】

【発明の効果】本発明によれば、部分表示領域の位置や面積あるいは表示内容をある時間間隔で変化させることにより、低消費電力性を維持した上で部分表示状態の画面に面白味や独創性を持たせることができる。

【図面の簡単な説明】

【図1】本発明の表示装置における部分表示状態を示す図。

【図2】本発明の表示装置における他の部分表示状態を示す図。

【図3】本発明の表示装置の構成例を示す図。

【図4】図3におけるコントローラの部分ブロック図。

【図5】図4の回路ブロックの動作を示すタイミング図。

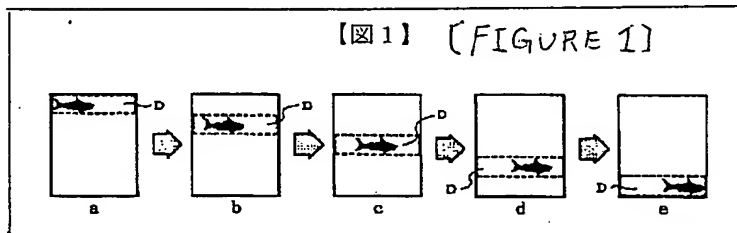【図6】本発明の電子機器の外観を示す図。

【図7】本発明の電子機器の部分回路ブロック図。
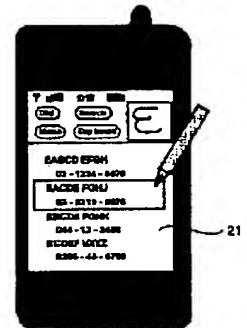
【図8】部分表示機能を有した従来の液晶表示装置の構成例を示す図。

【符号の説明】

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1，31 … 液晶表示パネル

2，32 … LCDコントローラ

3，33 … 駆動電圧形成部

4，34 … 走査電極駆動用ドライバ（Yドライバ）

5，35 … 信号電極駆動用ドライバ（Xドライバ）

6，26，36 … 電源

7… タイマー

8… レジスタ

9… 部分表示制御信号形成部

10… AND回路部

11… システムバス

21… 表示パネル

22… μPU

23… メモリ

24… 表示装置

25… 水晶振動子

37… 走査制御回路

D，D1，D2 … 部分表示領域

FRM … 画面走査開始信号

CLY … 走査信号転送用クロック

DnI，Dn … 表示データ

CLXI，CLX … データ転送用クロック

LPI，LP … データラッチ信号

CNT，PDY，PD … 部分表示用制御信号

【図1】 〔FIGURE 1〕
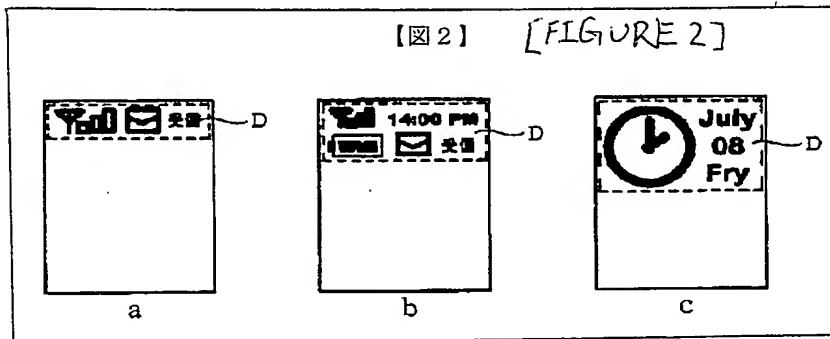
a ⇒ b ⇒ c ⇒ d ⇒ e

【図6】

【図2】 〔FIGURE 2〕

a   b   c

【図3】　【FIGURE3】

【図4】

【図7】

【図8】